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Dated 7 April 2003

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P01/7700 0.00-0208471.3

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12 APR 2002

The Patent Office
Cardiff Road
Newport
South Wales
NP9 1RH

1. Your reference — jp.PA 4405

2. Patent application number *(The Patent Office will fill in this part)* — 0208471.3

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Cursor Controls Limited
Conroi House
Brunel Drive
Newark
Nottinghamshire
NG24 2EG

Patents ADP number *(if you know it)* 8362832001

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — IMPROVED POINTING DEVICE

5. Name of your agent *(if you have one)* — **SOMMERVILLE & RUSHTON**

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

45 Grosvenor Road
St Albans
Herts AL1 3AW

Patents ADP number *(if you know it)* — 1511001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

Yes

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Continuation sheets of this form	0
Description	11
Claim(s)	3
Abstract	1
Drawing(s)	3

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Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	0
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	0

11. L/We request the grant of a patent on the basis of this application.

Signature: Somerville & Rushton Date: 12 April 2002

12. Name and daytime telephone number of person to contact in the United Kingdom: Dr James Pitchford 01727 854215

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Notes

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AN IMPROVED POINTING DEVICE

This invention relates to electronic pointing devices for use with a personal computer or other computer controlled electronic equipment. The term 'pointing device' should be interpreted broadly, to cover both mice and trackballs (also sometimes known as trackerballs). Such devices are typically used to control the movement of a cursor on a display screen.

Pointing devices or cursor control devices such as mice and trackballs are commonplace wherever there are computers or computer controlled equipment.

A pointing device is generally vulnerable to the ingress of liquid, which can cause potentially fatal damage to its internal circuitry and lead to failure of the device. In many cases, the environment in which the pointing device is situated greatly increases the risk of liquid ingress. Trackballs are often used in industrial locations such as factories, in which there may be an enhanced risk of liquid spillage. In some applications liquid ingress is virtually inevitable. For example, trackballs may be used to control ultrasound equipment in hospitals, where there is a high likelihood of ultrasound gel getting into the trackball mechanism. The term liquid as used herein should be taken to include gels, oils and other common fluids. Mice are also often prone to liquid ingress, which may result from accidents such as the spillage of a drink in an office. In outdoor applications, pointing devices are highly susceptible to the ingress of rainwater and other forms of precipitation.

If liquid is accidentally taken in by a pointing device, then this can also affect electrical or electronic apparatus connected or installed with it. In such cases the pointing device, and

often the associated apparatus too, must immediately be switched off, either to replace the pointing device if it now no longer works, or to enable it to dry out. It is generally not possible to continue using the device or associated apparatus immediately after the ingress of liquid. This down-time, when the device is out of service, can be expensive in commercial environments and potentially life threatening if the device was being used to control hospital equipment.

In instances where the device has not been rendered wholly inoperable by the ingress of liquid, but has nevertheless taken in liquid, it is often neither possible nor recommended to wash it clean again, as the cleaning water may itself cause further damage to the electronic components. However, cleaning may be necessary, particularly if the fouling liquid is dirty. Traditional trackballs and mice require a relatively skilled person to clean them, which is costly in both time and money.

Ingress of solid matter (e.g. dirt and powder particles etc.) is also detrimental to the operation of pointing devices.

It is a general object of the present invention to provide a pointing device which overcomes or at least mitigates some or all of the above disadvantages associated with traditional pointing devices.

According to the invention there is provided an electronic pointing or cursor control device comprising a first chamber and a second chamber, wherein: the two chambers are adjoined and separated by a fluid-tight separating wall; the first chamber contains electronic components; the second chamber comprises an aperture; the second chamber contains a

ball, the ball protruding through said aperture; the said separating wall comprises an optically permeable region; and the electronic components include optical detection means directed towards the optically permeable region and the ball, the detection means being operable in use to detect motion of the ball and to generate electronic signals representative of said motion.

Using two chambers separated by a fluid-tight wall provides the advantage that the electronic components are prevented from coming into contact with any liquid that enters the chamber containing the ball. The device is therefore not susceptible to damage from the effect of liquid coming into contact with the electronic components, and may continue to be used with liquid in the second chamber.

The two chambers being adjoined advantageously gives rise to a compact overall device that is relatively straightforward to manufacture.

The aperture through which the ball protrudes from the second chamber may be a hole or opening in a wall of the second chamber. Alternatively the second chamber may be open-ended (i.e. the aperture is in effect the absence of a wall altogether), in which case the pointing device may be adapted to be butted against an existing panel (e.g. in a control console), and the existing panel may have a hole through which the ball may protrude.

The term "optically permeable" should be interpreted as having the property of allowing optical signals to pass from the ball to the detection means such that, in use, the detection means can correctly detect motion of the ball.

Preferably the first chamber is fluid-tight.

Preferably the ball is mounted in the second chamber such that the distance in the second chamber between the surface of said optically permeable region and the surface of the ball is sufficiently small such that any liquid between the ball and the optically permeable region of the separating wall is thinly dispersed and does not prevent optical transmission between the ball and the detection means.

Particularly preferably the distance in the second chamber between the surface of said optically permeable region and the surface of the ball is less than 1.5 mm.

Preferably the detection means comprise an optical lens, the focal depth of said lens being such as to ensure that, irrespective of the nature of any liquid between the ball and the optically permeable region of the separating wall, the detection means are sufficiently focused to enable the device to operate.

In preferred embodiments the separating wall may be made of a translucent plastics material, or a clear plastics material with a textured finish. This provides the advantage of preventing users from readily seeing the internal components of the first chamber. The optically permeable region of the separating wall may comprise a polished region of the said plastics material.

Preferably the second chamber further comprises a drainage outlet. This advantageously enables any liquid that has entered the second chamber to drain out.

The second chamber may further comprise a cleaning fluid inlet. This advantageously enables cleaning fluid to be supplied into the second chamber and then out through the drainage outlet, thereby keeping the second chamber and the ball clean without the intervention of a cleaning person. Accordingly, the second chamber may contain a cleaning liquid.

Preferably the device is a trackball. Alternatively it may be a mouse.

Embodiments of the invention will now be described, by way of example, and with reference to the drawings in which:

Figure 1 illustrates a cross section of a trackball incorporating two separate chambers, one of which is fluid-tight and contains the electronic components, and the other of which contains the ball;

Figure 2 illustrates a cross section of another trackball wherein the chamber containing the ball has a drainage outlet, a cleaning fluid inlet, and contains some liquid therein; and

Figure 3 illustrates in cross section a mouse also in accordance with the present invention.

Figure 1 illustrates an optical trackball assembly 10 comprising two chambers 15, 16 separated by a fluid-tight separating wall 17 common to both chambers. The first chamber 15 is formed by the side walls 11, 13 of the device, the base panel 12 and the separating wall 17. The side walls 11, 13 and the separating wall 17 may be made from a single piece of material (e.g. a plastics moulding) which advantageously enables manufacturing costs to be minimised and the device to be made compact.

The first chamber 15 contains the electronic components the device requires for operation, principally a printed circuit board 22 and an optical sensor 26, details of which will be given later. The first chamber 15 is fluid-tight, thereby preventing liquid from the environment coming into contact with the electronic components 22, 26. A cable gland 28 is provided to enable a cable (not shown) to be connected to the circuit board 22 whilst still maintaining a sealed chamber. When in use, this cable is connected to another piece of equipment such as a personal computer or a piece of computer controlled machinery. The cable gland 28 may be located on a side wall (e.g. wall 11) of the first chamber, as an alternative to being underneath the device.

The second chamber 16 is open to the environment, and contains the ball 19 that, in use, is manipulated by a user, for example to control a cursor. The second chamber is formed by the side walls 11, 13, the separating wall 17, and the top panel 14. A chassis 20 is located within the second chamber 16, the chassis being adapted to support the ball 19. The top panel 14 may be removable, to enable the ball to be removed if necessary.

Since the first chamber 15 is separated from the second chamber 16 by the fluid-tight separating wall 17, any liquid that enters the second chamber from the environment cannot reach the electronic components. Indeed, a key aspect of this device is that there are no water-sensitive electronic components in the second chamber, and no electrical connections run between the chambers.

The fluid-tight separating wall 17 may also be used to separate explosive or harmful gases from the electronic components. This is particularly useful in petrol stations, refineries, gas plants and other instances in which there is a danger of explosion or fire resulting from the

ingress of flammable gases into electrical cabinets. Thus, flammable gases are safely contained in the second chamber 16, and do not reach the electronic components in the first chamber 15.

In use, movement of the ball is detected by a solid state optical sensor 26 directed towards the ball 19, and an LED (not illustrated) is used to provide the required incident illumination on the ball. The LED is mounted in the first chamber along with all the other electronic components. To enable the LED to illuminate the under-surface of the ball, and to enable the sensor 26 to receive optical signals from the ball, an optically permeable region 18 of sufficient size is provided in the separating wall 17. This optically permeable region 18 may be a region of transparent or translucent plastics material, or another material with the requisite properties as would be selected by a materials expert.

An optical lens 24 is positioned between the sensor 26 and the optically permeable region 18 of the separating wall 17. The optical lens 24 is adapted and arranged such that the focal depth of the sensor 26 is sufficient to enable it to detect correctly movement of the ball, even if there is liquid in the second chamber.

The ball 19 is a conventional ball as used in existing optical mice and trackballs. The surface or coated subsurface of the ball may incorporate a speckled pattern or other markings to enable the optical sensor 26 to detect the ball's motion.

Known optical mouse (or trackball) sensing technology may be employed for all the electronic components provided to detect optically the motion of the ball. Particularly suitable for this purpose is the Agilent Technologies HDNK-2000 solid state optical mouse

sensor kit. Details of the components of this kit are given in Appendix A. Alternatively the Agilent (RTM) ADNS-2051 sensor may be used in this application. Future derivatives of the ADNS-2051 sensor may also be used with minor changes to the electronic components.

Importantly, there is only a small gap in the second chamber 16 between the surface of the optically permeable region 18 of the separating wall 17 and the bottom of the ball 19, as indicated by d in Figure 1. This gap is preferably less than 1,5 mm, and is sufficiently small such that any liquid between the ball 19 and the optically permeable region 18 of the separating wall 17 is thinly dispersed and does not prevent optical transmission between the ball and the detection means.

The overall geometry of the device is such as to enable it to be retro-fitted in existing units, to replace previous trackballs.

Figure 2 illustrates schematically a trackball assembly 30 incorporating a drainage outlet 34 and an optional cleaning fluid inlet 32. The drainage outlet 34, which facilitates drainage of any liquid from the second chamber 16, may be provided without the cleaning fluid inlet 32. However, advantageously, the cleaning fluid inlet 32 enables a supply of cleaning fluid 36 to be delivered through the second chamber 16, thereby keeping the ball clean during use. As in the previous figure, the first chamber 16 contains all the necessary electronic components for sensing movement of the ball.

Finally, Figure 3 illustrates an optical mouse 50 also embodying aspects of the invention, namely two chambers 52, 54 separated by a fluid-tight separating wall 60. The first chamber 54 is fluid-tight and includes the electronic components including the optical sensor 58 and

the switch(es) for the mouse button(s) 64. The second chamber 52 houses the ball 56 and is open to the environment. The separating wall 60 separating the first and second chambers includes an optically permeable region 62 enabling the optical sensor apparatus to detect motion of the ball and to generate signals representative of that motion. Also shown in Figure 3 are internal electrical cables 68 which carry signals from the mouse button(s) 64 and the optical sensor 58, a cable gland 66, and an external cable 70 for connection to a computer.

Appendix A

Agilent Technologies HDNK-2000 Solid State Optical Mouse Sensor Kit

Kit Components

See table below.

Sensor

The sensor technical information is contained in the HDNS-2000 Data Sheet and Application Note 1179.

Lens

The lens information is contained in the HDNS-2100 Data Sheet and Application Note 1179.

LED Assembly Clip

The assembly information is contained in the HDNS-2200 Technical Data Sheet and the HDNS-2000 Application Note 1179.

LED

Information on the LED is contained in the HLMP-ED80 Data Sheet and Application Note 1179.

Base Plate Feature IGES File

The IGES file provides recommended base plate moulding features to ensure optical alignment.

Part Number	Description	Name
HDNS-2000	Solid state optical mouse sensor	Sensor
HDNS-2100	Lens plate	Lens
HDNS-2200	LED Assembly Clip	LED Clip
HLMP-ED80	639 nm T 1¾ (5 mm) diameter LED	LED
Documentation	HDNS-2000 Data Sheet	-
Documentation	HDNS-2100 Data Sheet	-
Documentation	HDNS-2200 Data Sheet	-
Documentation	LED Data Sheet	-
Documentation	Application Note 1179	-
Floppy Diskette	Base Plate Feature IGES File	-

The address of Agilent Technologies, Inc. is 395 Page Mill Road, Palo Alto, California 94303, United States of America.

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CLAIMS

1. An electronic pointing or cursor control device comprising a first chamber and a second chamber, wherein:

the two chambers are adjoined and separated by a fluid-tight separating wall;

the first chamber contains electronic components;

the second chamber comprises an aperture;

the second chamber contains a ball, the ball protruding through said aperture;

the said separating wall comprises an optically permeable region; and

the electronic components include optical detection means directed towards the optically permeable region and the ball, the detection means being operable in use to detect motion of the ball and to generate electronic signals representative of said motion.

2. A device as claimed in Claim 1, wherein the first chamber is fluid-tight.

3. A device as claimed in Claim 1 or Claim 2, wherein the distance in the second chamber between the surface of said optically permeable region and the surface of the ball is sufficiently small such that any liquid between the ball and the optically permeable region of the separating wall is thinly dispersed and does not prevent optical transmission between the ball and the detection means.

4. A device as claimed in any preceding Claim, wherein the distance in the second chamber between the surface of said optically permeable region and the surface of the ball is less than 1.5 mm.

5. A device as claimed in any preceding Claim, wherein the detection means comprise an optical lens, the focal depth of said lens being such as to ensure that, irrespective of the nature of any liquid between the ball and the optically permeable region of the separating wall, the detection means are sufficiently focused to enable the device to operate.

6. A device as claimed in any preceding Claim, wherein the separating wall is made of a translucent plastics material.

7. A device as claimed in Claim 6, wherein the optically permeable region of the separating wall comprises a polished region of the said plastics material.

8. A device as claimed in any preceding Claim, wherein the second chamber further comprises a drainage outlet.

9. A device as claimed in Claim 8, wherein the second chamber further comprises a cleaning fluid inlet.

10. A device as claimed in any preceding Claim, wherein the second chamber contains cleaning liquid.

11. A device as claimed in any preceding Claim being a trackball.

12. A device as claimed in any of Claims 1 to 8 being a mouse.

13. An electronic pointing or cursor control device substantially as hereinbefore described with reference to the accompanying drawings.

ABSTRACT

AN IMPROVED POINTING DEVICE

An electronic pointing or cursor control device comprising a first chamber and a second chamber, wherein: the two chambers are adjoined and separated by a fluid-tight separating wall; the first chamber contains electronic components; the second chamber comprises an aperture; the second chamber contains a ball, the ball protruding through said aperture; the said separating wall comprises an optically permeable region; and the electronic components include optical detection means directed towards the optically permeable region and the ball, the detection means being operable in use to detect motion of the ball and to generate electronic signals representative of said motion. The device may be a trackball or a mouse.

(Figure 1 to accompany abstract.)

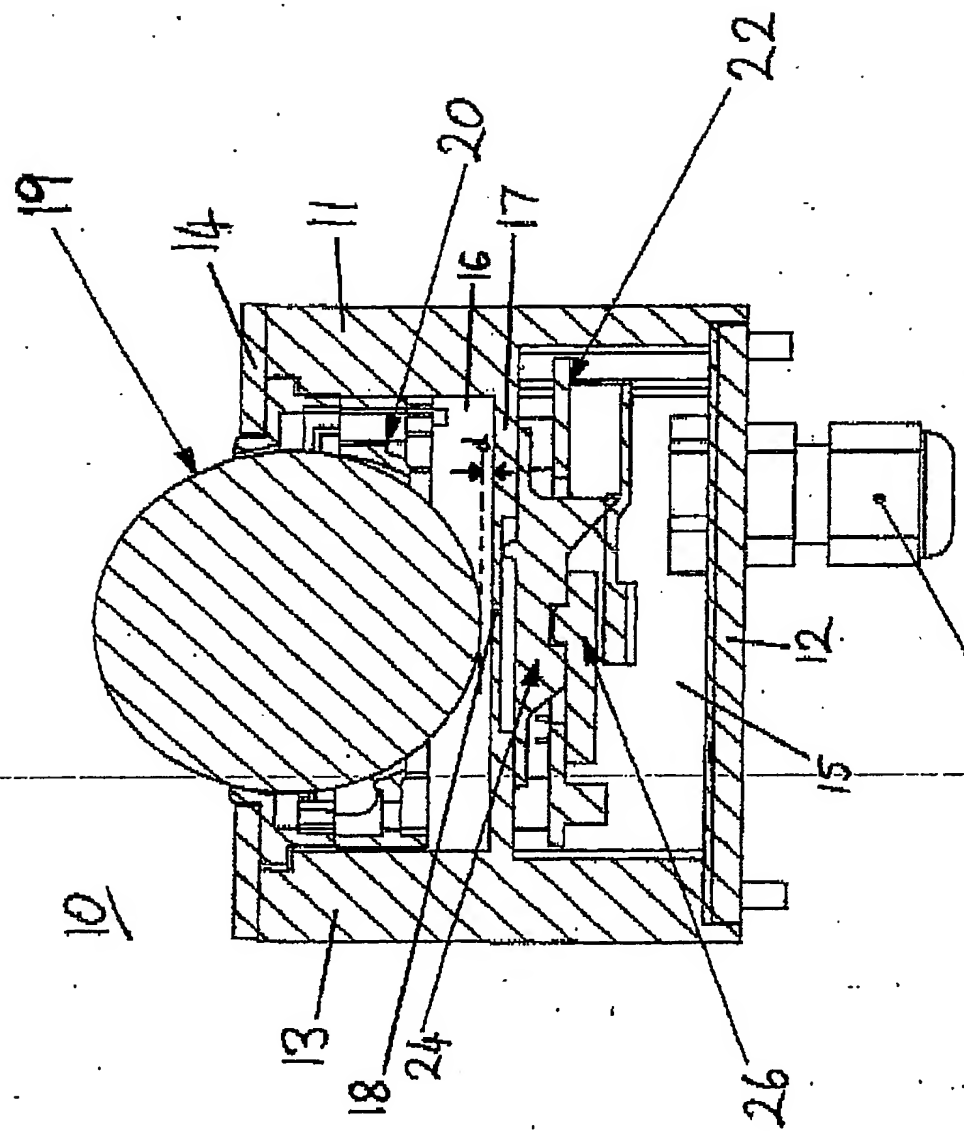

FIGURE 1

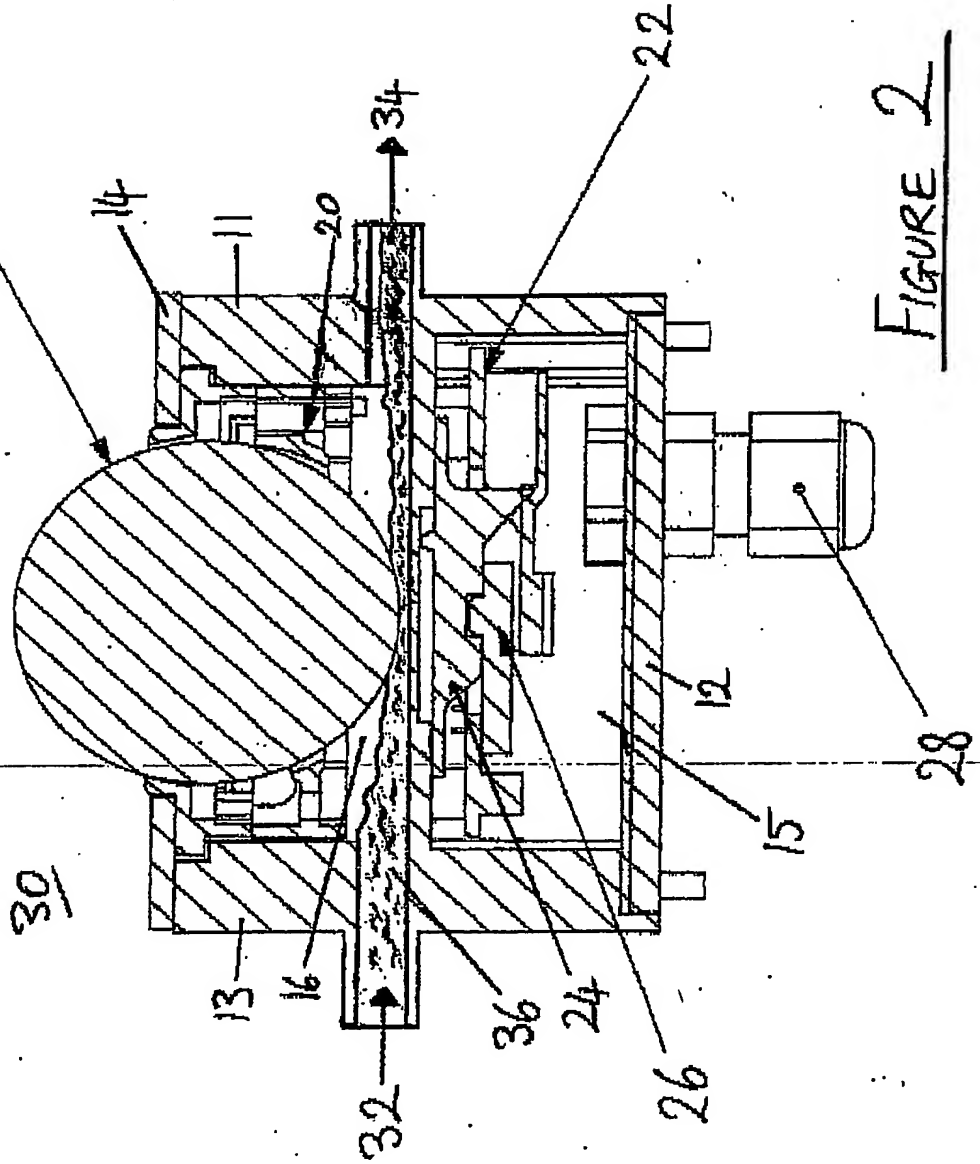

FIGURE 2

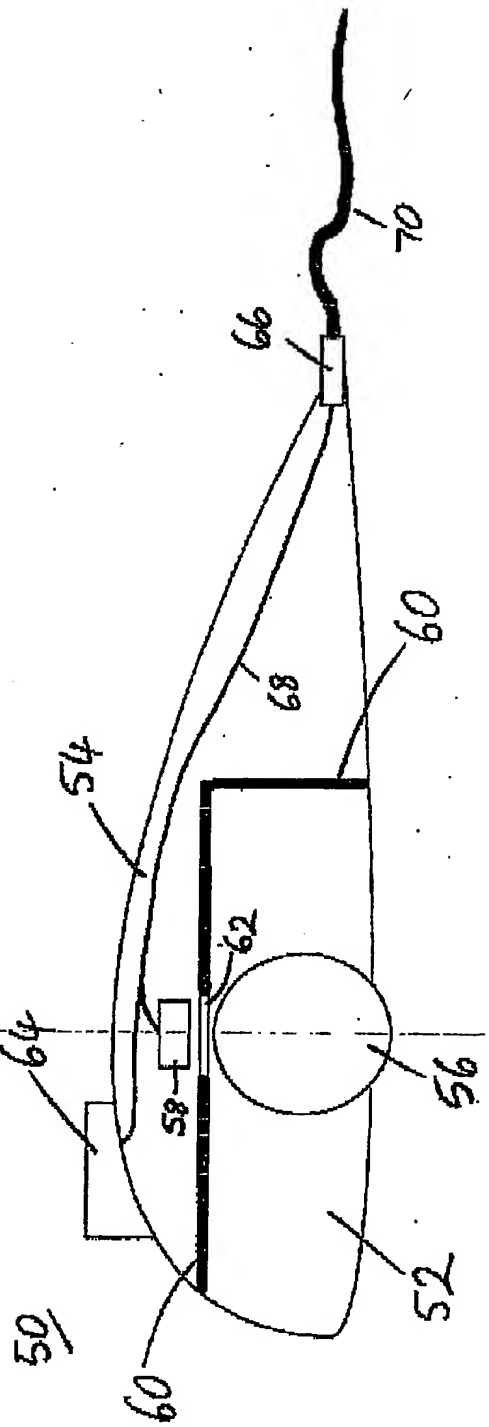

FIGURE 3